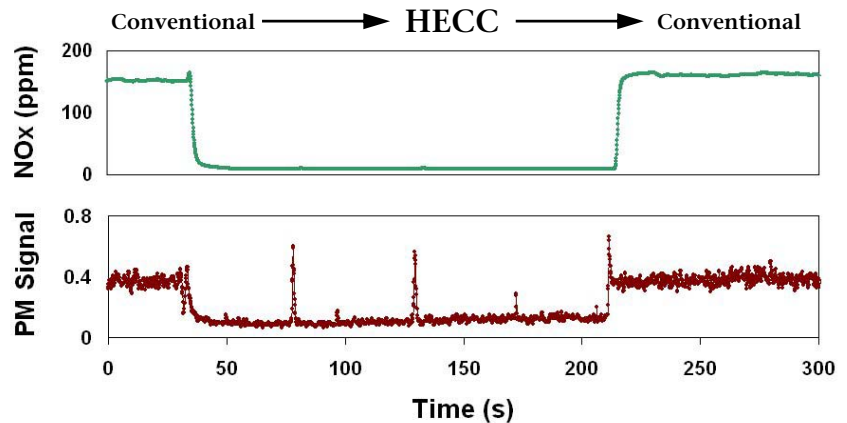


Achieving High Efficiency Clean Combustion in Diesel Engines

Background

Researchers at the Oak Ridge National Laboratory (ORNL) are exploring the potential of new combustion regimes that exhibit simultaneous low emissions for oxides of nitrogen (NO_x) and particulate matter (PM). Commonly referred to as high efficiency clean combustion (HECC), an improved understanding of these combustion modes is critical for lowering the performance requirements for post-combustion emissions controls and meeting future U.S. emissions and fuel efficiency goals.



Transitions into and out of HECC operation were demonstrated with no fuel efficiency penalty and with significant reductions in NO_x and PM emissions

The Technology

Through proper combustion management, ORNL has achieved significant reductions in NO_x and PM emissions without the decrease in efficiency typically associated with operating in these regimes. This type of operation was demonstrated on a multi-cylinder engine using only production-like hardware. This achievement is dramatically different from other approaches to HECC which may require expensive hardware modifications or require the acceptance of significant fuel penalties.

Another important aspect of operating diesel engines in advanced combustion modes is the ability to transition in and out of these modes with minimal adverse effects on emissions or

Benefits

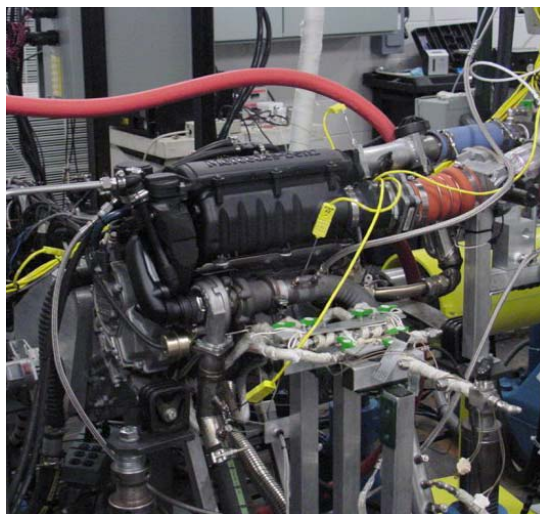
- Maintained or improved fuel efficiency with significant reductions in NO_x and PM emissions using only production-like controls
- Seamless transitions between normal and HECC modes
- Improved fundamental understanding of HECC modes through advanced thermodynamic and exhaust analysis

performance. ORNL researchers were able to demonstrate seamless transitions with no significant emissions excursions or effects on performance.

ORNL researchers are also applying powerful analytical methods to characterize exhaust constituents from conventional and new combustion regimes. The combination of thermodynamic and detailed exhaust chemistry information is expected to dramatically improve the understanding of HECC regimes and result in even cleaner and more efficient operation of diesel engines.

Commercialization

Commercial application of HECC strategies will require advances over a broad range of technologies including combustion mode sensing (direct or virtual), combustion control, mode transition control, and fuel formulation. ORNL is addressing these enabling technologies as a path to meeting the U.S. Department of Energy's goals of improved efficiency and emissions for diesel engines. The data from this project are also being shared with industry and other national laboratories for the development and validation of improved combustion models and catalysts.



Mercedes 1.7-liter engine used in HECC investigations at ORNL



Where Can I Find More Information?

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